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(71) Applicant: DATAPRODUCTS CORPORATION [US/US]; 1757 Tapo Canyon Road, Simi Valley, CA 93063 (US).

(72) Inventors: PETOSKEY, Dennis, G.; 200 Whisper Way, Dacula, GA 30211 (US). DEAN, Michael, C.; 200 Pruit Drive, Alpharetta, GA 30201 (US).

(74) Agents: KOVELMAN, Paul, K. et al.; Loeb & Loeb LLP, Suite 2200, 10100 Santa Monica Boulevard, Los Angeles, CA 90067 (US).

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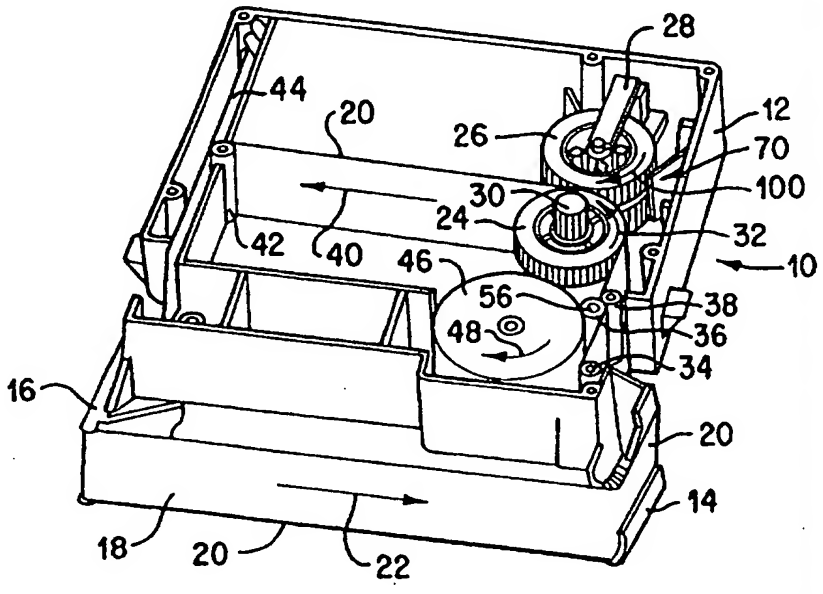
(54) Title: INK RIBBON CARTRIDGE HAVING IMPROVED TRANSFER ROLLER AND IMPROVED ANTI-REVERSING MECHANISM

(57) Abstract

In an ink ribbon cartridge (1) (or cartridge ribbon) in which a length of ink ribbon (20) driven through the cartridge (1) is re-inked by a rotatable foam cylinder (46) or reinker saturated with ink, an improved transfer roller (36) is provided for transferring ink from the reinker (46) onto the surface of the ink ribbon (20) as the ink ribbon (20) is advanced past the transfer roller (36). The transfer roller (36) is of generally cylindrical shape and is provided with a plurality of elongated raised ridges or teeth (52) on the outer surface thereof. The teeth (52) present a surface area which transfers a desired amount of ink from the reinker (46) to the ink ribbon (20) as the ink ribbon (20) rotates the transfer roller (36), and thereby the reinker (46). At the same time, positive engagement of the transfer roller (36) with the ink ribbon (20) and the reinker (46) is enhanced, for the given surface area presented by the teeth (52), by offsetting or staggering a lower arrangement (66) of the teeth (52) relative to an upper arrangement (64) thereof on the outer surface of the transfer roller (36). The ink ribbon cartridge (1) also has an anti-reversing mechanism (70) for preventing movement of the ink ribbon (20) in a reverse direction. The anti-reversing mechanism (70) includes a leaf spring (72) having a portion thereof with an edge (76) resiliently bearing against an outer surface of one of the gear assemblies (78, 80). The same outer surface, which is toothed, also functions as a drive surface and engages the ink ribbon (20) in an adjacent location. The leaf spring (72), which is angled relative to the gear assembly (78, 80) so as to permit rotation in a desired direction, while immediately engaging the toothed drive surface (82, 84) to prevent rotation in the reverse direction, forms an acute angle with a base portion thereof mounted against an upstanding side wall of the cartridge case (12).



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INK RIBBON CARTRIDGE HAVING IMPROVED TRANSFER ROLLER AND IMPROVED ANTI-REVERSING MECHANISM

Background Of The Invention

1. Field Of The Invention

The present invention relates to ink ribbon cartridges, and more particularly to ink ribbon cartridges in which a transfer roller is used to transfer ink from a foam cylinder to a length of ink ribbon which is selectively advanced through the cartridge in unidirectional fashion.

2. History Of The Prior Art

It is known to provide ink ribbon cartridges (or "cartridge ribbons" as they are commonly known in the industry) for use in conjunction with various types of impact printers. An example of an impact printer which uses an ink ribbon cartridge is a printer specially designed to print small items such as lottery tickets at the point of sale of such tickets. Lottery ticket printers comprise a form of dot matrix printer in which the ink ribbon cartridge is mounted within the printer adjacent a print head. The print head undergoes reciprocating motion relative to a portion of the ink ribbon extending across the front of the ink ribbon cartridge, to effect impact printing of the paper.

As impact printing is carried out by the printer, the length of ink ribbon within the cartridge is periodically advanced in a given direction. Ribbon advancement is typically accomplished using a drive motor external to the cartridge and having a drive spindle engaging a shaft of a drive gear assembly within the cartridge. The drive gear assembly and an opposing idler gear assembly, mounted within the cartridge case, resiliently engage the length of ink ribbon therebetween so as to selectively advance the length of ink ribbon through the cartridge and across the front thereof to provide for impact printing by the print head.

The periodic advancement of the length of ink ribbon through the cartridge is necessary in order to continuously replenish the supply of ink in the ribbon as it is used up during the printing operation. Typically, the length of ribbon is inked by an arrangement which includes a rotatable foam cylinder (or "reinker" as it is commonly known in the

industry). The foam reinker is saturated with ink. As the length of ink ribbon is advanced through the cartridge by the drive gear assembly and the opposing idler gear assembly, the ink ribbon rotates a transfer roller which is rotatably positioned adjacent the path of the ink ribbon so as to engage the ribbon. This rotates the transfer roller. Because the transfer roller also engages the reinker, this rotates the reinker as well. As the reinker is rotated, ink stored therein is transferred onto the surface of the transfer roller. As the transfer roller is rotated, the ink on the surface thereof is transferred onto the ink ribbon. In this manner, the ink ribbon is continuously provided with a fresh supply of ink.

The design and operation of the transfer roller are critical to the successful re-inking of the ink ribbon. The transfer roller must securely engage both the ink ribbon and the reinker, so that the transfer roller and the reinker are rotated by the passing ink ribbon. Lack of proper engagement of the transfer roller with either the ink ribbon or the reinker can result in slipping and stalling, and eventual malfunction of the ribbon cartridge. In addition to proper engagement and driving of the transfer roller and the reinker, the transfer roller must transfer the correct amount of ink from the reinker to the ink ribbon. Too little ink can result in light printing. On the other hand, too much ink can lead to heavy printing, blotchiness and even jamming of the cartridge. In an effort to ensure positive engagement of the transfer roller with both the ink ribbon and the reinker, most conventional transfer rollers present a relatively large amount of the surface area thereof to the ink ribbon and the reinker, using teeth or other projections from the surface, with the resulting tendency to transfer too much ink to the ink ribbon. Efforts to reduce such surface area in an effort to reduce the amount of transferred ink often result in less than positive engagement of the transfer roller, with resulting slippage and occasional stalling or jamming of the cartridge.

It would therefore be desirable to provide an improved ink ribbon cartridge transfer roller. Such roller should be capable of transferring desired amounts of ink from the reinker to the ink ribbon while at the same time providing positive engagement of the transfer roller with the ink ribbon and the reinker so as to prevent slipping and stalling.

The ink ribbon cartridge is designed to permit movement of the ink ribbon therethrough in one direction only. This enables the ink ribbon to pass by the transfer roller and associated reinker for continuous transfer of a fresh supply of ink thereon, following which the ink ribbon is advanced through and then out of the cartridge case and along a front portion of the cartridge case for use by the print head. Because of the relatively complex path of the ink ribbon through the cartridge, bi-directional movement of the ink ribbon therethrough is to be avoided, inasmuch as it can easily lead to ribbon jams and to damage of

the ribbon cartridge.

Apart from the drive motor which drives the ink ribbon through the cartridge in the desired direction, there are at least two other sources of possible movement of the ink ribbon. As previously noted, the print head moves in bi-directional fashion relative to a portion of the ink ribbon extending across the front end of the cartridge. When the print head is moving in the same direction as the desired direction of ribbon movement, the ribbon moves somewhat faster than the print head, so that the print head does not interfere with the ribbon movement. However, when the print head is moving in the opposite direction, and the ink ribbon is stationary, the print head can engage the ink ribbon to a sufficient extent to move the ink ribbon in the unwanted, reverse direction. If this happens, the print head can drag the ribbon out of the cartridge, leading to jams or damage of the cartridge. Movement of the ink ribbon by the operator is also possible. The cartridge is provided with an upstanding portion of the shaft for the drive gear assembly, which extends out of the top of the cartridge case. This enables the operator to manually advance the ink ribbon through the cartridge, as may be necessary during installation of the cartridge or during operation of the printer. Typically, an arrow is printed or otherwise formed on the top of the cartridge case to indicate to the operator the permitted direction of rotation of the drive gear assembly shaft. However, operators sometimes rotate the shaft in the opposite direction, often leading to jamming of the ribbon within the cartridge. Consequently, most ink ribbon cartridges of this type are provided with some form of anti-reversing mechanism.

One form of anti-reversing mechanism in common use involves a pawl and ratchet assembly. Typically, the pawl and ratchet are molded into a bottom portion of either the drive gear assembly or the idler gear assembly. Such assemblies tend to operate in relatively crude fashion, permitting as much as 5-10° or more of reverse movement before lockup occurs. Moreover, because the pawl and ratchet mechanism is formed at a bottom portion of one of the gear assemblies, away from the actual drive surface thereof which engages the ink ribbon, a further slack or tolerance can occur between the mechanism and the ink ribbon, permitting even further unwanted movement in the reverse direction. Reverse movements of the ink ribbon by such large amounts are unacceptable for many applications of the ink ribbon cartridge, and can lead to ribbon jams and to damage of the cartridge.

It would therefore be desirable to provide an improved anti-reversing mechanism for use with ink ribbon cartridges. It would furthermore be desirable to provide an anti-reversing mechanism for ink ribbon cartridges which is relatively simple and inexpensive, and which locks up almost immediately to allow almost no reverse movement of the ink ribbon.

Brief Summary Of The Invention

Briefly stated, the present invention provides an improved transfer roller for use with ink ribbon cartridges. The improved transfer roller is capable of transferring desired amounts of ink from an engaging foam cylinder or reinker to a passing length of ink ribbon, also engaged by the transfer roller, while at the same time maintaining positive engagement of the transfer roller with the length of ink ribbon and the reinker so as to prevent slippage or stalling. The present invention also provides an improved anti-reversing mechanism for an ink ribbon cartridge, which quickly deploys to prevent reverse movement of the ink ribbon when needed. The mechanism is precise so as to typically permit 1° or less of reverse movement of the ink ribbon before lockup. In addition, the mechanism works directly on a drive surface of one of the gear assemblies, close to the place of engagement of the drive surface with the ink ribbon, so as to minimize or eliminate any play or slack therebetween.

Improved transfer rollers in accordance with the invention are generally cylindrical in shape and are provided at an outer surface thereof with an arrangement of elongated ridges or teeth. The teeth have a surface area which transfers the desired amount of ink from the reinker to the ink ribbon. At the same time, the teeth engage both the reinker and the ink ribbon in a positive manner which prevents slipping or stalling relative thereto.

In accordance with a feature of the invention the elongated teeth at the outer surface of the transfer roller are arranged into upper and lower arrangements thereof which are offset relative to each other. This "staggering" of the teeth at the outer surface of the transfer roller has the effect of presenting a half tooth twice as often, to the ink ribbon and the reinker, as compared with the case of each tooth extending continuously along the entire length of the transfer roller. As a result, the offset or staggered arrangement of the teeth provides for improved engagement of the transfer roller with the ink ribbon and the reinker. This allows the teeth to be made smaller and to be spaced further apart from each other, so that a correct amount of ink is transferred while at the same time maintaining positive engagement of the transfer roller with the ink ribbon and the reinker.

In a preferred embodiment of the improved transfer roller, the upper and lower arrangements of teeth on the outer surface of the cylindrical roller and approximately equal in length along the central axis of rotation of the roller. The teeth of the lower arrangement extend along the entire length of the lower portion and are generally equally spaced from each other around the outer surface of the roller and are generally parallel to the central axis. Likewise, the teeth of the upper arrangement extend along the entire length of the upper portion of the roller, are generally equidistantly spaced from each other, and are generally

parallel to the central axis. At the same time, the teeth of the upper and lower arrangements are offset or staggered, such that each tooth of the upper arrangement is disposed approximately equidistantly between a pair of the teeth in the lower arrangement.

In a preferred embodiment of an anti-reversing mechanism according to the invention, the mechanism is used in conjunction with a drive or idler gear assembly having one or more tires with outer surfaces driving the ink ribbon. The drive surfaces of the tires are provided with a continuous array of very fine teeth. A leaf spring is mounted adjacent an edge of the gear assembly so that a portion thereof extends at an angle relative to and terminates in an end thereof resiliently engaging the toothed outer drive surface or surfaces of the gear assembly. Because the leaf spring is angled relative to the gear assembly, the resiliently biased leaf spring simply rides over the toothed drive surface to permit rotation of the gear assembly in the desired direction of ink ribbon movement. However, as soon as rotation of the gear assembly in the reverse direction is attempted, the angled leaf spring locks the outer end thereof against one of the teeth of the drive surface, thereby preventing further rotation of the gear assembly in the reverse direction. The quick action of the leaf spring in conjunction with the relatively small and closely spaced teeth of the drive surface permit very little reverse movement of the ink ribbon before lock-up takes place. In addition, use of the drive surface of the gear assembly, at a location thereof close to the portion of the gear assembly engaging the ink ribbon, further minimizes the amount of reverse motion which the ink ribbon can undergo. In the preferred embodiment, the angled portion of the leaf spring extends from a relatively flat base portion thereof with which it forms an acute angle. The base portion is mounted against an upstanding sidewall of the cartridge case to secure the leaf spring in place.

Brief Description Of The Drawings

A detailed description of the invention will be made with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view of an ink ribbon cartridge having an improved transfer roller and an improved anti-reversing mechanism in accordance with the invention;

Fig. 2 is a perspective view of the cartridge of Fig. 1 with the top of the cartridge case removed in order to show the interior details thereof;

Fig. 3 is a top view of a portion of the cartridge of Figs. 1 and 2, showing the interrelationship of the transfer roller with the ink ribbon and the reinker;

Fig. 4 is a front elevational view of a portion of the cartridge of Figs. 1 and 2,

showing the manner in which the transfer roller simultaneously engages the ink ribbon and the reinker;

Fig. 5 is an enlarged perspective view of the transfer roller;

Fig. 6 is an enlarged perspective view of the idler gear assembly of the ink ribbon cartridge of Figs. 1 and 2 together with the leaf spring which forms part of the anti-reversing mechanism; and

Fig. 7 is an enlarged top view of a portion of the ink ribbon cartridge of Figs. 1 and 2 showing the idler gear assembly and the leaf spring in further detail, including the manner in which the leaf spring is mounted within the case of the cartridge.

Detailed Description

Figs. 1 and 2 show an ink ribbon cartridge or cartridge ribbon 10 having an improved transfer roller and an improved anti-reversing mechanism in accordance with the invention. The ink ribbon cartridge 10 includes a case 12 of relatively thin, generally planar configuration. The case 12 has an opposite pair of projecting portions 14 and 16 at the front thereof for presenting a portion 18 of a continuous length of ink ribbon 20 for use by an adjacent print head (not shown) for impact printing. The ink ribbon 20 is periodically advanced, in a direction shown by an arrow 22 at the portion 18 thereof, by a drive mechanism located at the interior of the case 12. The drive mechanism includes a drive gear assembly 24 and an opposing idler gear assembly 26 disposed opposite the drive gear assembly 24. The idler gear assembly 26 is biased toward the drive gear assembly 24 by a spring loaded mechanism 28 on which it is mounted. The drive gear assembly 24 is rotatably mounted on a shaft 30 having a lower end which protrudes slightly from an underside of the cartridge case 12. Engagement of the lower end of the shaft 30 by a drive spindle of a motor (not shown) external to the cartridge 10 periodically rotates the drive gear assembly 24 in a direction shown by an arrow 32, to advance the ink ribbon 20 through the cartridge 10.

The portion 18 of the ink ribbon 20 extends across the front of the cartridge 10, between the projecting portions 14 and 16, as previously noted. At the rear of the projecting portion 14, the ribbon 20 undergoes two different 90° bends, so as to elevate the plane of motion of the ribbon, before it enters the case 12 and wraps around an idler roller 34. From the idler roller 34, the ribbon 20 extends partly around a rotatably mounted transfer roller 36, where the ribbon 20 is held in engagement with the transfer roller 36 by an adjacent idler roller 38. From the idler roller 38, the ribbon 20 extends around the drive gear assembly 24 and against the opposing idler gear assembly 26. Periodic driving of the drive gear assembly

24 advances the ink ribbon 20 through the cartridge 10, as previously described. From the drive gear assembly 24, the ink ribbon 20 moves across the interior of the cartridge case 12, in a direction shown by an arrow 40, to an idler roller 42. From the idler roller 42, the ink ribbon 20 extends forwardly to the rear of the projecting portion 16, where the ink ribbon 20 undergoes two 90° bends before wrapping around the projecting portion 16 and extending across the front of the cartridge 10. A drag spring 44 at the rear left of the cartridge case 12 resiliently bears against the ink ribbon 20, at the idler roller 42, to retard the motion of the ink ribbon 20, making the ribbon motion more consistent.

As the ink ribbon 20 is moved through the ribbon path, defined by the various gear assemblies and idler rollers within the case 12, the supply of ink in the ribbon 20 is replenished by an arrangement which includes the transfer roller 36 and a rotatable foam cylinder or reinker 46. As the ribbon 20 is advanced around the transfer roller 36, the idler roller 38 forces the ribbon 20 against the transfer roller 36 to enhance the engagement of the ribbon 20 with the transfer roller 36 and thereby ensure that the transfer roller 36 rotates with movement of the ribbon 20. At the same time, the transfer roller 36 engages an outer surface of the reinker 46, causing the reinker 46 to rotate as the transfer roller 36 rotates. The reinker 46 rotates in a direction shown by an arrow 48. As the transfer roller 36 and the reinker 46 rotate, the reinker 46 transfers ink onto the outer surface of the transfer roller 36, and the transfer roller 36 in turn transfers the ink onto the ink ribbon 20.

The details of the path of movement of the ribbon 20 and the transfer of ink from the reinker 46 to the ribbon 20, are better shown by the views of Figs. 3 and 4. After wrapping around the idler roller 34, the ribbon 20 advances to the interface between the transfer roller 36 and the idler roller 38. As previously noted, the idler roller 38 enhances engagement of the ribbon 20 by the transfer roller 36. From the interface of the transfer roller 36 and the idler roller 38, the ribbon 20 extends to and wraps around the drive gear assembly 24. As the drive gear assembly 24 periodically advances the ribbon 20, the ribbon 20 is pulled through the interface of the transfer roller 36 with the idler roller 38, and this rotates the transfer roller 36 in a direction shown by an arrow 50 in Fig. 3. At the same time, and because the transfer roller 36 engages the reinker 46, rotation of the transfer roller 36 rotates the reinker 46 in the direction shown by the arrow 48.

As will be appreciated, the transfer roller 36 is an important component in driving the reinker 46 in response to motion of the ribbon 20 so that ink is continuously supplied from the reinker 46, via the transfer roller 36, to the ribbon 20, as the ribbon 20 is advanced through the cartridge 20. The transfer roller 36 is designed to maintain positive engagement

with the ribbon 20 and the reinker 46, while at the same time transferring a desired amount of ink from the reinker 46 to the ribbon 20. The positive engagement of the transfer roller 36 with the ribbon 20 and the reinker 46 is necessary in order to prevent slippage or eventual stalling which can jam the cartridge 10. At the same time, the portion of the surface of the transfer roller 36 coming into contact with the reinker 46 must transfer a desired amount of ink to the ribbon 20. Too little ink being transferred can result in light printing, while too much ink can result in heavy print, blotchiness and even eventual jamming of the cartridge 10.

The transfer roller 36, which is shown in detail in Fig. 5, has been found to provide a successful compromise, inasmuch as it transfers the desired amount of ink while at the same time maintaining positive, non-slip engagement with the ribbon 20 and the reinker 46. As shown in Fig. 5, the transfer roller 36 is provided with a plurality of elongated ridge-like teeth 52 at an outer surface thereof. The transfer roller 36 is of generally cylindrical configuration, and is provided with a central bore 54 extending therethrough. The central bore 54 receives an upstanding pin 56, shown in Figs. 2, 3 and 4 to rotatably mount the transfer roller 36 within the case 12 of the cartridge 10. The bore 54 extends along a central axis 58 of the transfer roller 36.

The transfer roller 36 is comprised of upper and lower portions 60 and 62 of approximately equal length. The upper portion 60 includes a first arrangement 64 of the elongated teeth 52. Each of the teeth 52 of the upper arrangement 64 extends along the entire length of the upper portion 60 of the transfer roller 36, and is generally parallel with the central axis 58. In addition, the teeth 52 of the upper arrangement 64 are generally equally spaced around the outer periphery or circumference of the upper portion 60. In similar fashion, the lower portion 62 of the transfer roller 36 is provided with a second arrangement 66 of the elongated teeth 52, such that each such tooth 52 extends along the entire length of the lower portion 62 and is generally parallel with the central axis 58. As in the case of the upper tooth arrangement 64, the teeth 52 of the lower arrangement 66 are generally equally spaced around the outer periphery of the lower portion 62. The arrangements 64 and 66 contain like numbers of the teeth 52, and the spacing between adjacent pairs of teeth in each of the arrangements 64 and 66 is similar. Also, the upper and lower portions 60 and 62 are equal in length, in the direction of the central axis 58, so that the teeth 52 in the arrangements 64 and 66 have like lengths.

As shown in Fig. 5, the teeth 52 of the lower arrangement 66 are offset or "staggered" relative to the teeth 52 of the upper arrangement 64. More specifically, and in

the example of Fig. 5, each tooth 52 of the upper arrangement 64 is positioned so as to be equidistantly spaced between a pair of the teeth 52 of the lower arrangement 66. The resulting offset or staggered pattern of the teeth 52 has the effect of presenting a half tooth twice as often, as would be the case if the teeth 52 extended continuously along the entire length of the transfer roller 36. As a result, improved engagement is achieved between the transfer roller 36 and the ribbon 20 and the reinker 46, even though the total area of the outer surfaces of the teeth 52 is considerably less than in the case of prior art transfer rollers where the contact area must be increased to provide for positive engagement. The reduced surface area presented by the teeth 52 of the arrangement of Fig. 5 provides for the transfer of a desired amount of ink from the reinker 46 to the ribbon 20. The increased surface area needed for positive engagement of the transfer roller 36, in prior art arrangements, tends to transfer too much ink to the ribbon 20.

The transfer roller 36 may be made of any appropriate material such as plastic. In the present example, the transfer roller 36 is molded of plastic, so that the teeth 52 are integrally formed with the cylinder comprising the main portion of the transfer roller 36. The offset or staggered configuration of the teeth 52 can be achieved by forming the upper and lower portions 60 and 62 of virtually identical configuration, and then joining them together so that the teeth 52 thereof are offset in the desired manner.

In accordance with the invention, and as shown in Fig. 2, the ink ribbon cartridge 10 is provided with an improved anti-reversing mechanism 70, which is shown in detail in Figs. 6 and 7. The anti-reversing mechanism 70 includes one of the gear assemblies 24 and 26, each of which has an outer drive surface engaging the ink ribbon 20. In the present example, the anti-reversing mechanism includes the idler gear assembly 26, but it should be understood that the drive gear assembly 24 can also be used in conjunction therewith. In addition to the idler gear assembly 26, the anti-reversing mechanism 70 includes a leaf spring 72. As shown in Fig. 6, the leaf spring 72 is positioned adjacent the idler gear assembly 26 so that a portion 74 thereof extends at an angle relative to the idler gear assembly 26 and terminates in an edge 76. In the present example, the idler gear assembly 26, includes a pair of tires 78 and 80 having toothed outer drive surfaces 82 and 84 thereof. The leaf spring 72 resiliently urges the angled portion 74 thereof in an outward direction, so that the edge 76 is resiliently biased against the drive surfaces 82 and 84 of the tires 78 and 80. The portion 74 is bent relative to, and forms an acute angle with, a base portion 86 of the leaf spring 72.

As shown in Fig. 7, the base portion 86 of the leaf spring 72 is mounted against the inside of an upstanding side wall 88 of the cartridge case 12. Lateral movement of the base

portion 86 is prevented by opposite tabs 90 and 92 extending outwardly from the inner surface of the side wall 88. In addition, pillars 94, 96 and 98 which extend upwardly from the bottom of the case 12 prevent movement of the base portion 86 away from the side wall 88 and maintain the portion 74 of the leaf spring 72 in the desired position.

As previously described in connection with Fig. 2, rotation of the drive gear assembly 24 in the direction of the arrow 32 advances the ink ribbon 20 in the desired direction through the cartridge 10. The spring loaded mechanism 28 biases the idler gear assembly 26 in a direction toward the drive gear assembly 24 to engage the ink ribbon 20 therebetween. As the drive gear assembly 24 rotates in the direction of the arrow 32 to advance the ink ribbon 20, this results in the idler gear assembly 26 rotating in a direction shown by an arrow 100 in Figs. 2, 6 and 7. As long as the idler gear assembly 26 rotates in the direction of the arrow 100 to provide movement of the ink ribbon 26 in the desired direction, the portion 74 of the leaf spring 72 simply rides over the toothed surfaces 82 and 84 of the tires 78 and 80. However, as soon as movement of the ink ribbon 20 in the reverse direction is attempted, the edge 76 of the portion 74 of the leaf spring 72 quickly engages teeth at the drive surfaces 82 and 84, thereby quickly locking up to prevent any consequential movement of the ink ribbon 20 in the reverse direction. The small sizes of the teeth forming the drive surfaces 82 and 84, and the nature of the leaf spring 72 with its edge 76 resiliently bearing against the drive surfaces 82 and 84, combine to provide for rapid lockup in the event reverse motion of the ink ribbon 20 is attempted. Furthermore, the "slack" of the anti-reversing mechanism 70 is further reduced by virtue of the fact that the portion 74 of the leaf spring 72 engages the actual drive surfaces 82 and 84 of the idler gear assembly 26, which surfaces engage and drive the ink ribbon 20 a very short distance away from the edge 76 of the leaf spring 72. Consequently, the anti-reversing mechanism 70 limits the possible reverse motion of the idler gear assembly 26 and the engaged ink ribbon 20 to typically no more than 1° of rotation of the idler gear assembly 26, and in some cases considerably less rotational motion such as on the order of 1/2°.

The anti-reversing mechanism 70 is described in conjunction with the idler gear assembly 26, inasmuch as the leaf spring 72 is conveniently mounted for interaction therewith, in the present example. However, it should be understood that the leaf spring 72 can also be used in conjunction with the drive gear assembly 24. In that event, the same advantages arise, inasmuch as the outer surfaces of the tires comprising the drive gear assembly 24 also define drive surfaces in engagement with the ink ribbon 20.

While the invention has been particularly shown and described with reference to

preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

WHAT IS CLAIMED IS:

1. An ink ribbon cartridge comprising the combination of:

a cartridge case;

means defining a ribbon path through the cartridge case;

a length of ink ribbon disposed along the ribbon path within the cartridge case;

a rotatable cylindrical element for storing a quantity of ink, mounted within the cartridge case;

a transfer roller rotatably mounted within the cartridge case to engage the length of ink ribbon and the rotatable cylindrical element, the transfer roller having a plurality of elongated teeth extending outwardly from an outer surface thereof;

a rotatable gear assembly mounted within the cartridge case and having an outer driving surface engaging the length of ink ribbon; and

a leaf spring mounted in the cartridge case and having an edge resiliently bearing against the driving surface of the rotatable gear assembly to prevent rotation of the gear assembly in a reverse direction and thereby movement of the ink ribbon in a reverse direction along the ribbon path.

2. An ink ribbon cartridge comprising the combination of:

a cartridge case;

means defining a ribbon path through the cartridge case;

a length of ink ribbon disposed along the ribbon path within the cartridge case;

a rotatable cylindrical element for storing a quantity of ink, mounted within the cartridge case; and

a transfer roller rotatably mounted within the cartridge case to engage the length of ink ribbon and the rotatable cylindrical element, the transfer roller having a plurality of elongated teeth extending outwardly from an outer surface thereof.

3. The invention set forth in claim 2, wherein the transfer roller has a central axis of rotation and the plurality of elongated teeth are generally parallel to the central axis and are generally equally spaced around an outer surface of the transfer roller.

4. The invention set forth in claim 2, wherein the plurality of elongated teeth are arranged into upper and lower arrangements in which the teeth of the upper arrangement are offset from the teeth in the lower arrangement.

5. The invention set forth in claim 4, wherein the transfer roller is in the shape of a cylinder having a central axis of rotation, the lower arrangement includes a plurality of spaced-apart teeth extending along a length thereof in the direction of the central axis and the upper arrangement includes a plurality of spaced-apart teeth extending along a length thereof in the direction of the central axis and each being positioned between a pair of the teeth of the lower arrangement.

6. The invention set forth in claim 5, wherein the upper and lower arrangements have like numbers of teeth.

7. In an ink ribbon cartridge, an arrangement for inking a length of ribbon movable along a ribbon path within the cartridge comprising:

a generally cylindrical transfer roller rotatably mounted within the cartridge and in contact with the length of ribbon, the transfer roller having a first plurality of outwardly extending teeth on an upper portion thereof and a second plurality of outwardly extending teeth on a lower portion thereof, the teeth of the lower portion being offset from the teeth of the upper portion around a circumference of the transfer roller; and

a cylindrical foam element rotatably mounted within the cartridge, the foam element being capable of storing a quantity of ink therein and having an outer surface thereof in contact with the transfer roller;

whereby movement of the length of ribbon rotates the transfer roller which in turn rotates the foam element so that ink on the foam element is transferred to the length of ribbon by the first and second pluralities of teeth of the transfer roller.

8. A transfer roller for use with an ink ribbon cartridge comprising:

a generally cylindrical body having opposite upper and lower portions and a central axis of rotation;

a first plurality of elongated teeth extending outwardly from the upper portion of the body and being generally equally spaced around a circumference of the upper portion of the body and each being generally parallel to the central axis; and

a second plurality of elongated teeth extending outwardly from the lower portion of the body and being generally equally spaced around a circumference of the lower portion of the body and each being generally parallel to the central axis;

the first and second pluralities of elongated teeth being offset relative to each other such that each of the first plurality of elongated teeth is disposed approximately equidistantly between a pair of elongated teeth of the second plurality of elongated teeth.

9. The invention set forth in claim 8, wherein the body is made of plastic and the first and second pluralities of elongated teeth are made of plastic and are integrally formed with the body.

10. The invention set forth in claim 8, wherein the upper and lower portions of the body are approximately equal in length along the central axis, the teeth of the first plurality extend along the entire length of the upper portion and the teeth of the second plurality extend along the entire length of the lower portion.

11. An ink ribbon cartridge comprising the combination of:

a cartridge case;

means defining a ribbon path through the cartridge case;

a length of ink ribbon disposed along the ribbon path within the cartridge case;

means within the cartridge case for applying ink to the length of ink ribbon;

a rotatable gear assembly mounted within the cartridge case and having an outer driving surface engaging the length of ink ribbon; and

a leaf spring mounted in the cartridge case and having an edge resiliently bearing against the driving surface of the rotatable gear assembly to prevent rotation of the gear assembly in a reverse direction and thereby movement of the ink ribbon in a reverse direction along the ribbon path.

12. The invention set forth in claim 11, wherein the driving surface of the rotatable gear assembly is toothed and a portion of the leaf spring terminating in the edge is angled relative to the rotatable gear assembly so that the edge engages the toothed driving surface to prevent rotation of the gear assembly in the reverse direction while sliding over the toothed driving surface to permit rotation of the gear assembly in a desired direction opposite the reverse direction.

13. The invention set forth in claim 11, further including a drive gear assembly mounted within the cartridge case and having an outer driving surface engaging the length of ink ribbon to selectively drive the ink ribbon in a direction opposite the reverse direction, and wherein the rotatable gear assembly comprises an idler gear assembly mounted on an opposite side of the ink ribbon from the drive gear assembly and being spring-loaded so as to squeeze the ink ribbon between the outer driving surface of the idler gear assembly and the outer driving surface of the drive gear assembly.

14. In an ink ribbon cartridge having an ink ribbon movable in a desired direction through the cartridge, an arrangement for preventing movement of the ink ribbon in a reverse direction opposite the desired direction comprising a rotatable member having an outer driving surface in engagement with the ink ribbon and an anti-reversing member engaging the outer driving surface of the rotatable member to prevent rotation of the rotatable member in a direction permitting movement of the ink ribbon in the reverse direction.

15. The invention set forth in claim 14, wherein the anti-reversing member resiliently engages the outer driving surface of the rotatable member.

16. The invention set forth in claim 15, wherein the driving surface of the rotatable member is toothed and the anti-reversing member comprises a leaf spring extending in angled fashion relative to the rotatable member and terminating in an edge which engages the toothed driving surface of the rotatable member.

17. An ink ribbon cartridge having an anti-reversing mechanism comprising:

a cartridge case;

an ink ribbon;

a rotatable foam element for storing a quantity of ink therein;

means defining a path of movement of the ink ribbon through the cartridge case, including a transfer roller engaging both the ink ribbon and the rotatable foam element to provide the ink ribbon with ink, and an opposing pair of rotatable gear assemblies for selectively driving the ink ribbon along the path of movement and each having a driving surface engaging the ink ribbon; and

an anti-reversing mechanism for preventing movement of the ink ribbon in a direction opposite a desired direction, the mechanism including a leaf spring having an edge thereof resiliently engaging the driving surface of one of the opposing pair of rotatable gear assemblies to prevent rotation of the one of the opposing pair of rotatable gear assemblies in a direction in which the ribbon moves in a direction opposite the desired direction.

18. The invention set forth in claim 17, wherein the cartridge case has an upstanding wall extending around an outer periphery thereof, and the leaf spring has a base portion secured against the upstanding wall of the cartridge case and a second portion forming an acute angle with the base portion and terminating in the edge resiliently engaging the driving surface of one of the opposing pair of rotatable gear assemblies.

19. The invention set forth in claim 18, wherein the one of the opposing pair of rotatable gear assemblies includes a pair of spaced-apart rotatable tires having toothed outer surfaces defining the driving surface of the one of the opposing pair of rotatable gear assemblies.

AMENDED CLAIMS

[received by the International Bureau on 2 October 1997 (02.10.97); new claims 20-26 added; remaining claims unchanged (3 pages)]

opposite a desired direction, the mechanism including a leaf spring having an edge thereof resiliently engaging the driving surface of one of the opposing pair of rotatable gear assemblies to prevent rotation of the one of the opposing pair of rotatable gear assemblies in a direction in which the ribbon moves in a direction opposite the desired direction.

18. The invention set forth in claim 17, wherein the cartridge case has an upstanding wall extending around an outer periphery thereof, and the leaf spring has a base portion secured against the upstanding wall of the cartridge case and a second portion forming an acute angle with the base portion and terminating in the edge resiliently engaging the driving surface of one of the opposing pair of rotatable gear assemblies.

19. The invention set forth in claim 18, wherein the one of the opposing pair of rotatable gear assemblies includes a pair of spaced-apart rotatable tires having toothed outer surfaces defining the driving surface of the one of the opposing pair of rotatable gear assemblies.

20. An ink ribbon cartridge comprising the combination of:

a cartridge case;

means defining a ribbon path through the cartridge case;

a length of ink ribbon disposed along the ribbon path within the cartridge case;

a rotatable cylindrical element for storing a quantity of ink, mounted within the cartridge case; and

a transfer roller rotatably mounted within the cartridge case to engage the length of ink ribbon and the rotatable cylindrical element, said transfer roller being rotated soely in response to movement of the length of ink ribbon which in turn rotates the rotatable cylindrical element so that ink on the rotatable cylindrical element is transferred to the length of ink ribbon by the transfer roller, the transfer roller having a plurality of elongated teeth extending outwardly from an outer surface thereof and spaced apart from each other around the circumference of the outer surface, the plurality of elongated teeth being arranged into upper and lower arrangements in which the teeth of the upper arrangement are staggered relative to the teeth in the lower arrangement around the circumference of the outer surface of the transfer roller.

21. The invention set forth in claim 20, wherein the transfer roller is in the shape of a cylinder having a central axis of rotation, the lower arrangement includes a plurality of spaced-apart teeth extending along a length thereof in the direction of the central axis and the upper

arrangement includes a plurality of spaced-apart teeth extending along a length thereof in the direction of the central axis and each being positioned between a pair of the teeth of the lower arrangement.

22. The invention set forth in claim 21, wherein the upper and lower arrangements have like numbers of teeth.

23. In an ink ribbon cartridge, an arrangement for inking a length of ribbon movable along a ribbon path within the cartridge comprising:

a generally cylindrical transfer roller rotatably mounted within the cartridge and in contact with the length of ribbon, the transfer roller having a first plurality of outwardly extending teeth on an upper portion thereof and a second plurality of outwardly extending teeth on a lower portion thereof, the teeth of the lower portion being staggered relative to the teeth of the upper portion around a circumference of the transfer roller; and

a cylindrical foam element rotatably mounted within the cartridge, the foam element being capable of storing a quantity of ink therein and having an outer surface thereof in contact with the transfer roller;

said transfer roller being rotated solely in response to movement of the length of ribbon which in turn rotates the foam element so that ink on the foam element is transferred to the length of ribbon by the first and second pluralities of teeth of the transfer roller.

24. A transfer roller for use with an ink ribbon cartridge comprising:

a body having a cylindrical outer surface and a central axis of rotation and being divided into opposite upper and lower portions;

a first plurality of elongated, ridge-like teeth extending outwardly from the cylindrical outer surface along the upper portion of the body and being generally equally spaced around a circumference of the body and each being generally parallel to the central axis; and

a second plurality of elongated, ridge-like teeth extending outwardly from the cylindrical outer surface along the lower portion of the body and being generally equally spaced around [a] the circumference of the body and each being generally parallel to the central axis:

the first and second pluralities of elongated teeth being staggered relative to each other around the circumference of the body such that each of the first plurality of elongated. ridge-like teeth is disposed approximately equidistantly between a pair of [elongated] teeth of the second plurality of elongated, ridge-like teeth.

25. The invention set forth in claim 24, wherein the body is made of plastic and the first and second pluralities of elongated, ridge-like teeth are made of plastic and are integrally formed with the body.

26. The invention set forth in claim 24, wherein the upper and lower portions of the body are approximately equal in length along the central axis, the teeth of the first plurality extend along the entire length of the upper portion and the teeth of the second plurality extend along the entire length of the lower portion.

H:\KOVELMAN\006133\FD4962\CLAIMS19.SUB

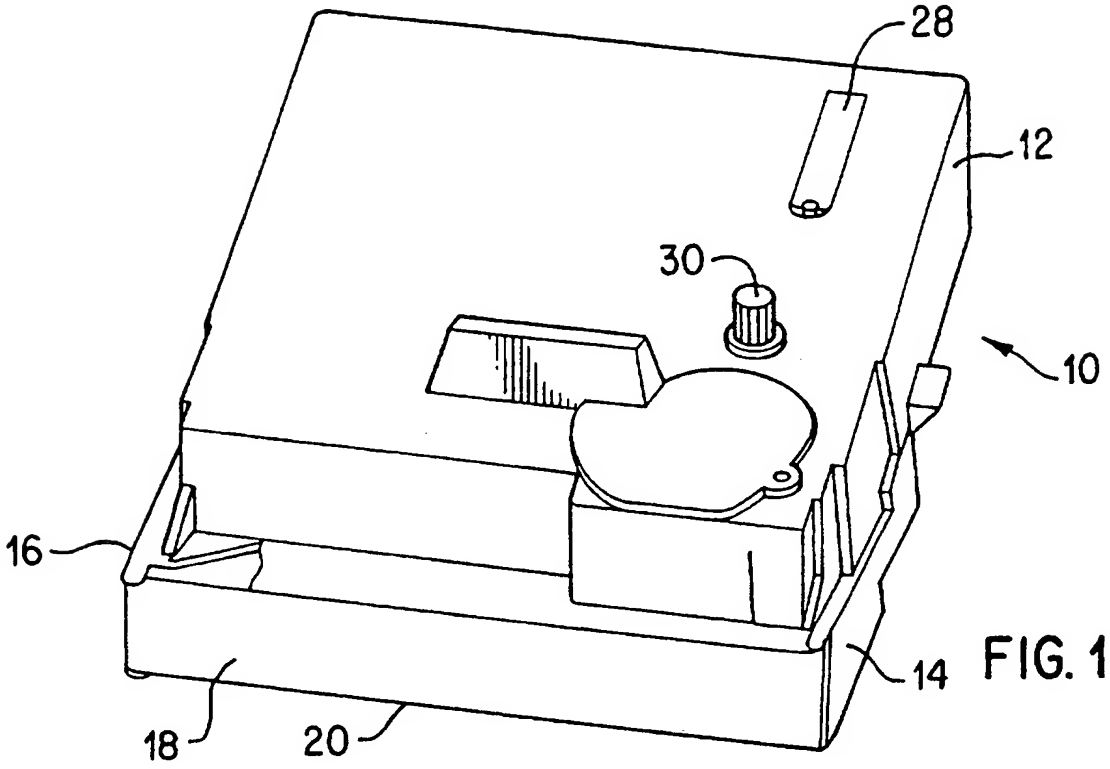

FIG. 1

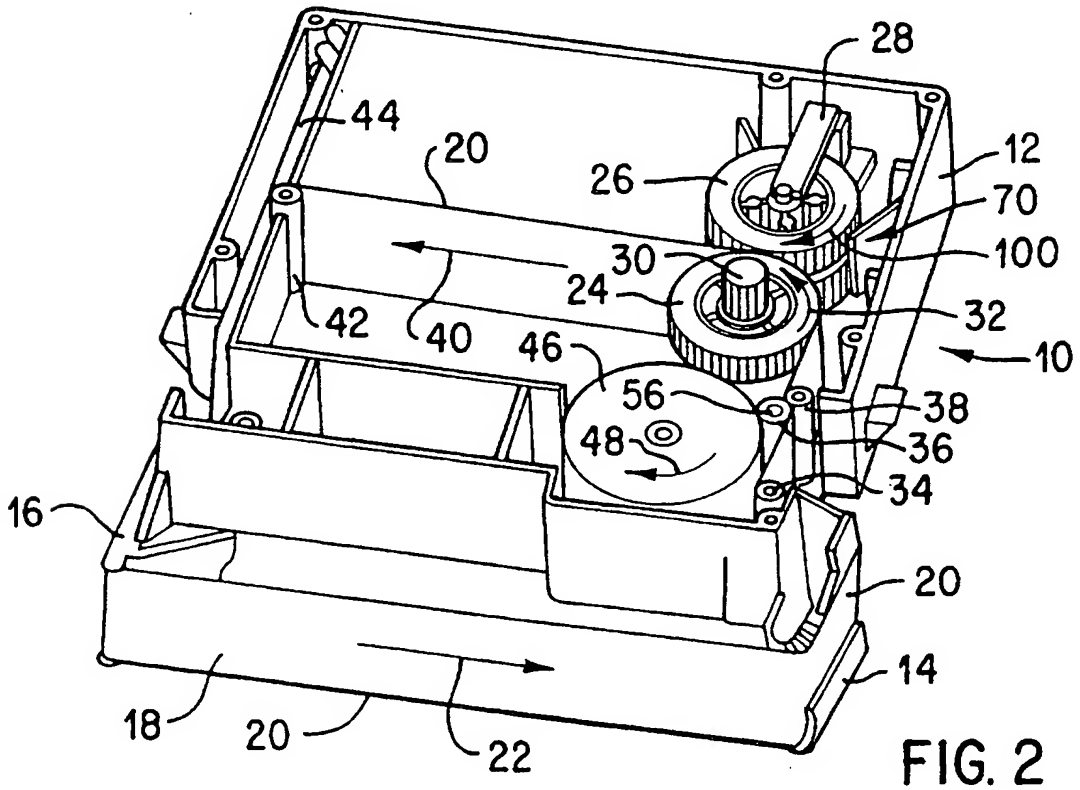

FIG. 2

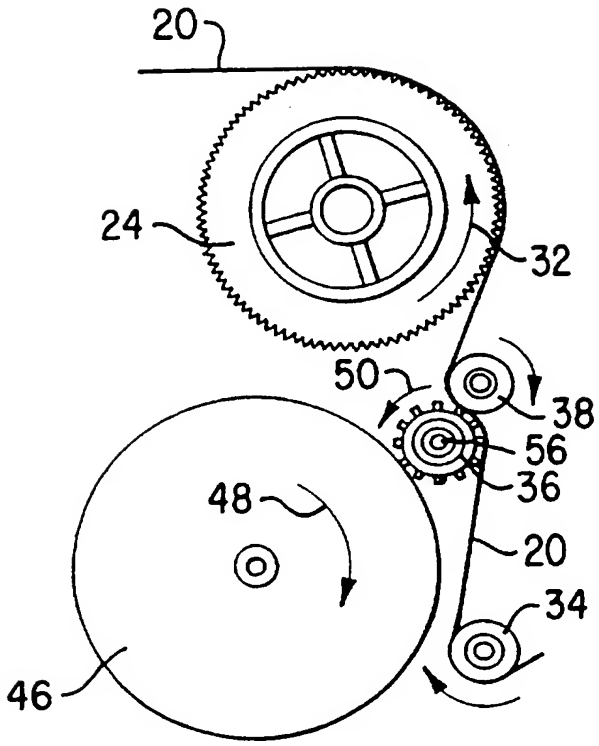

FIG. 3

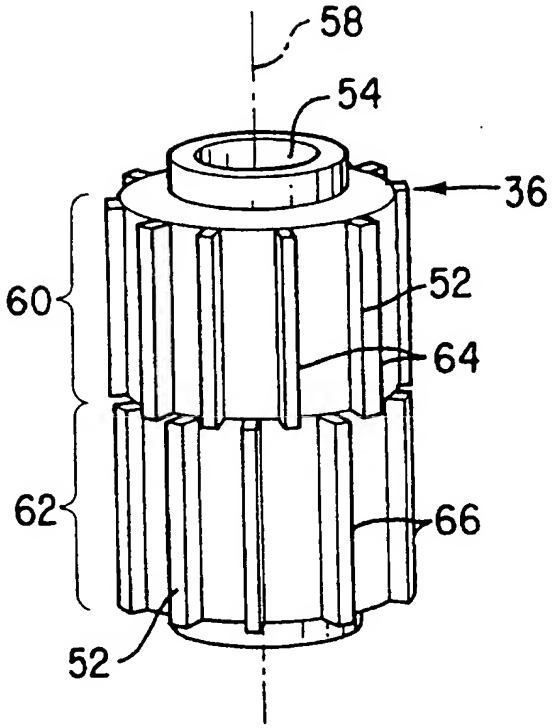

FIG. 5

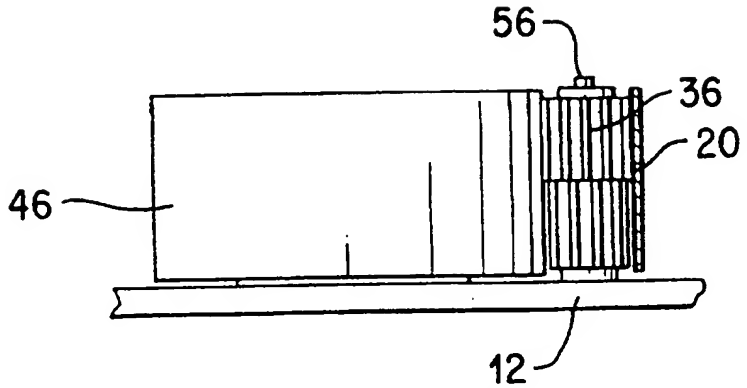

FIG. 4

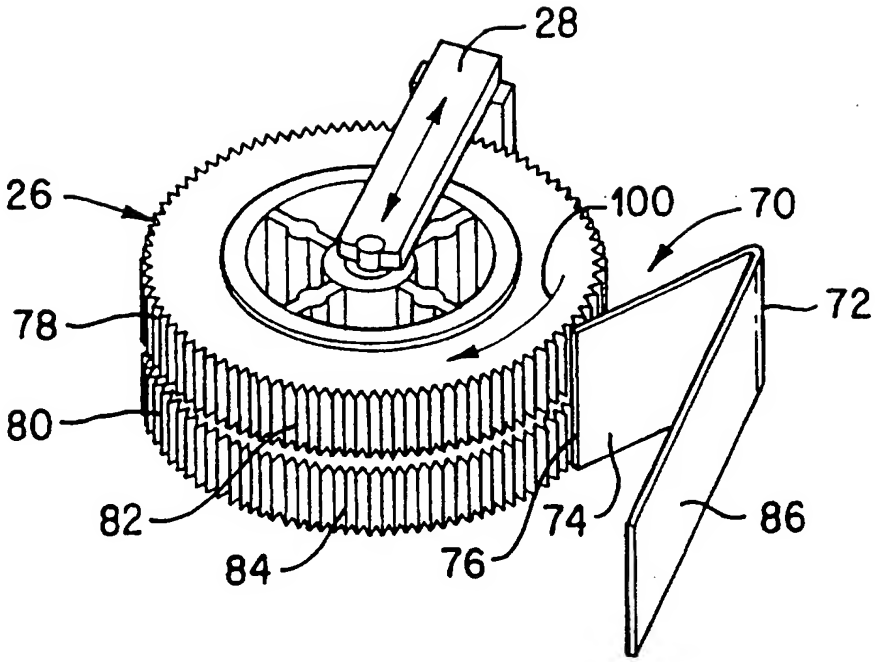

FIG. 6

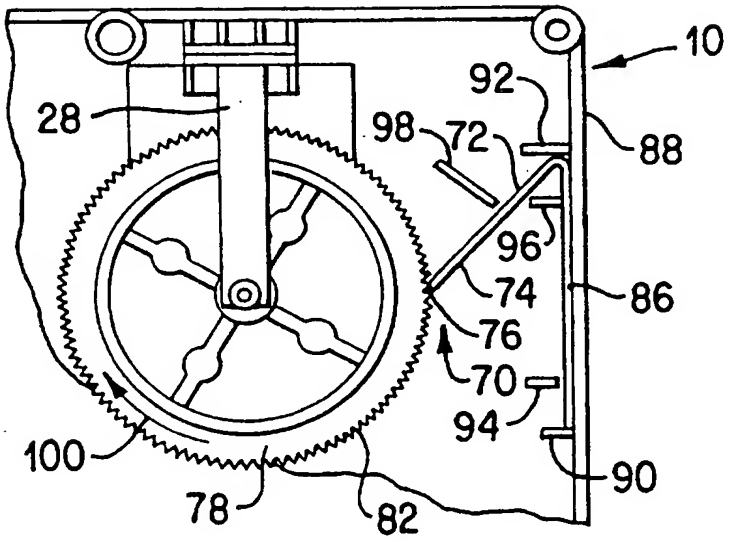

FIG. 7

INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/US 97/08870

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B41J31/16 B41J32/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B41J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 15, no. 407 (M-1169), 17 January 1991 & JP 03 169583 A (SEIKO EPSON CORP), 23 July 1991, see abstract	14-16
Y	---	1-3,11, 12,17
Y	EP 0 314 254 A (MERLIN C.T.C. PRODUCTION DIVISION NEDERLAND B.V.) 3 May 1989 see column 2, line 26 - line 41 see column 3, line 7 - line 16; figures 2,3	1-3,11, 12,17
A	---	7,8
	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 August 1997	19.08.97

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	Ducreau, F

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INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/US 97/08870

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	IBM TECHNICAL DISCLOSURE BULLETIN, vol. 35, no. 7, December 1992, ARMONK, NY, US, pages 493-494, XP000333112 "RE-INKING ROLLER FOR INK RIBBON CARTRIDGE" see the whole document	1-3,7,8, 11,12
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A	EP 0 367 706 A (INTERNATIONAL BUSINESS MACHINES CORPORATION) 9 May 1990 see column 3, line 16 - line 25 see column 3, line 33 - line 36 see column 4, line 28 - line 30; figures 1,2	1-3,7-9, 11,12,17

1

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Information on patent family members

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